Ground Enterprise Management System

Emergent Space Technologies, Inc.

Technical Abstract

Emergent Space Technologies Inc. proposes to develop the Ground Enterprise Management System (GEMS) for spacecraft ground systems. GEMS will provide situational awareness for distributed ground systems, and an understanding of how events and automated actions impact the system in real-time. Recent software advancements have improved sustainability, extensibility, fault tolerance, and ease of automation for ground systems. These traits are important for NASA's missions, from Exploration to Earth and Space Science, but can pose challenges, especially when the system has a high degree of interoperability and communications between components that isn't visible to the end-user. Operators can quickly become overwhelmed with the increased complexity of software components constantly exchanging data and the volumes of information being passed around behind-the-scenes. In fact, for largely distributed systems, as much "situational awareness" is needed for the ground system as for the spacecraft itself. GEMS will provide a centralized integration framework that is needed to provide operators with transparency into the ground system, its state, and its component interactions. GEMS will enhance plug-and-play integrations while providing information management and system coordination. The innovation that enables GEMS is the development of "data-driven" algorithms and software adapters that gather data from the various components of the ground system to construct a data model that captures the system state, organizes the data, and displays it to the mission operators.

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Intelliviz - An Intelligent Telemetry Data Visualization Assistant

Stottler Henke Associates, Inc.

Technical Abstract

Future space programs will require extensive monitoring of complex, highly instrumented systems such as the Orion spacecraft and lunar/Martian habitats. To handle tasks and situations that cannot be fully delegated to automation software, future flight controllers and crew must be able to monitor, review and interpret voluminous and complex telemetry data quickly to maintain necessary levels of situations awareness and make critical decisions rapidly and accurately. We propose to develop Intelliviz, an intelligent telemetry data visualization assistant for NASA. This software system will create data visualizations automatically to reduce the effort and difficulty of specifying and constructing effective telemetry data visualizations. Intelliviz will determine the user's data analysis goals by enabling users to express their data analysis goals directly and by posing system diagnosis or system management questions or problems from which analysis goals can be inferred. Intelliviz will then generate appropriate displays that support the user's data analysis goals by retrieving the relevant telemetry and systems data, selecting appropriate data display methods, and instantiating and configuring those displays. During the prior Phase 1 SBIR project, we reviewed research literature describing prior work in automated visualization design, reviewed related NASA R&D programs, specified scenarios and test cases, identified promising early applications for Intelliviz, refined our requirements and design, implemented a software prototype that demonstrates Intelliviz capabilities, and developed a plan to create an operational prototype during Phase 2. During the phase 2 project proposed in this document, we will develop a technology readiness level 6 operational prototype of Intelliviz to demonstrate its feasibility, utility, and usability by a NASA-relevant user community and task area.

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